

New York State Energy Research & Development Authority Activities in Solid State Lighting

**DOE Solid State Lighting Workshop
July 17, 2007**



- **NYSERDA's Mission**

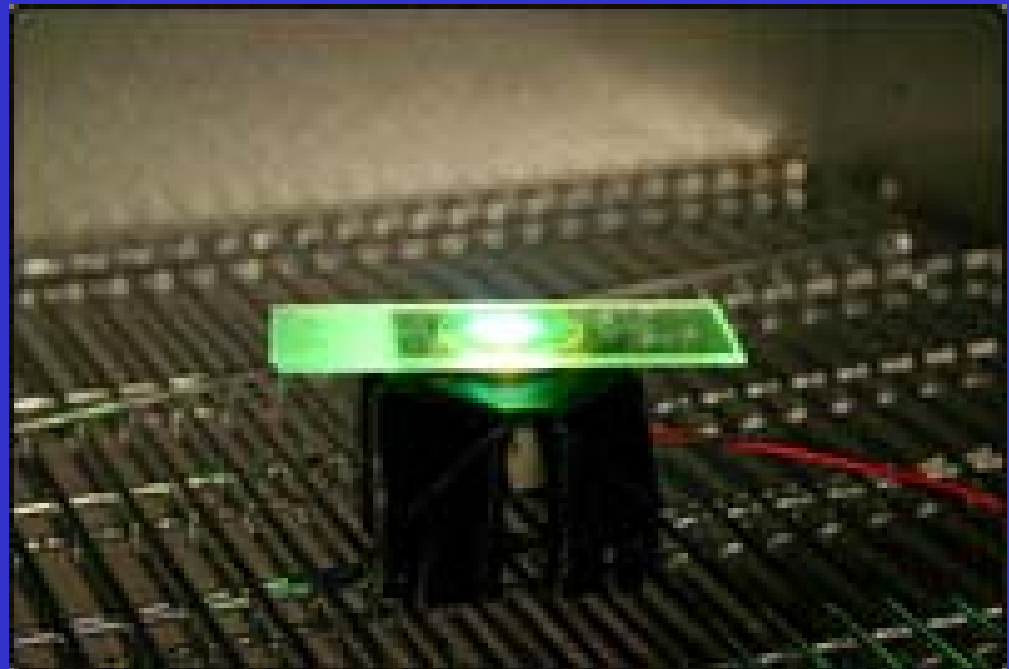
Use innovation and technology to solve some of New York's most difficult energy and environmental problems in ways that improve the State's economy

- **R&D Program**
- **Residential Sector Promotion**
- **Commercial & Industrial Sector Activities**

NYSERDA Solid State Lighting Research & Development Projects



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R&D Program & SSL Research

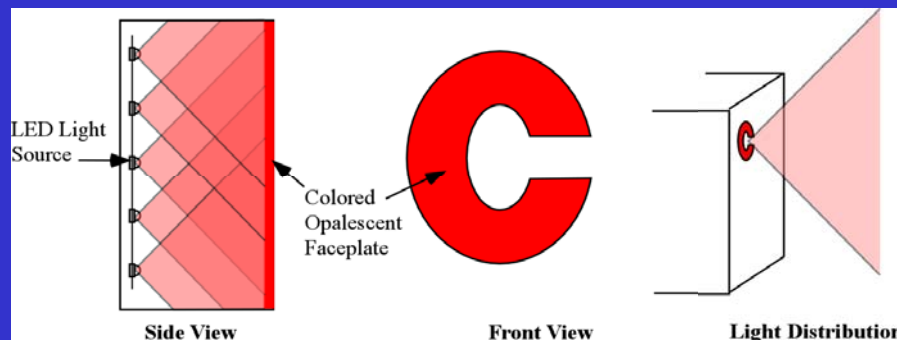
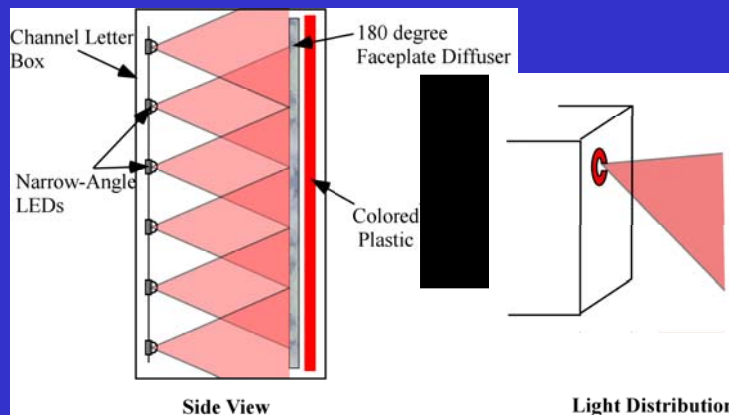
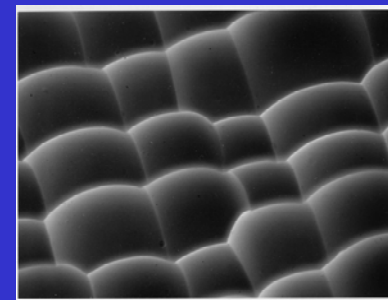
New Product Development
Demonstration Projects
Testing & Evaluation
Education



Improving the Efficiency, Visibility, and Performance of LED Signage

RPC Photonics & RPI Lighting Research Center

Goal: Develop an LED-based back-lighted that
is up to 80% more efficient than current neon signs
has improved brightness uniformity
has improved light distribution to reduce light pollution

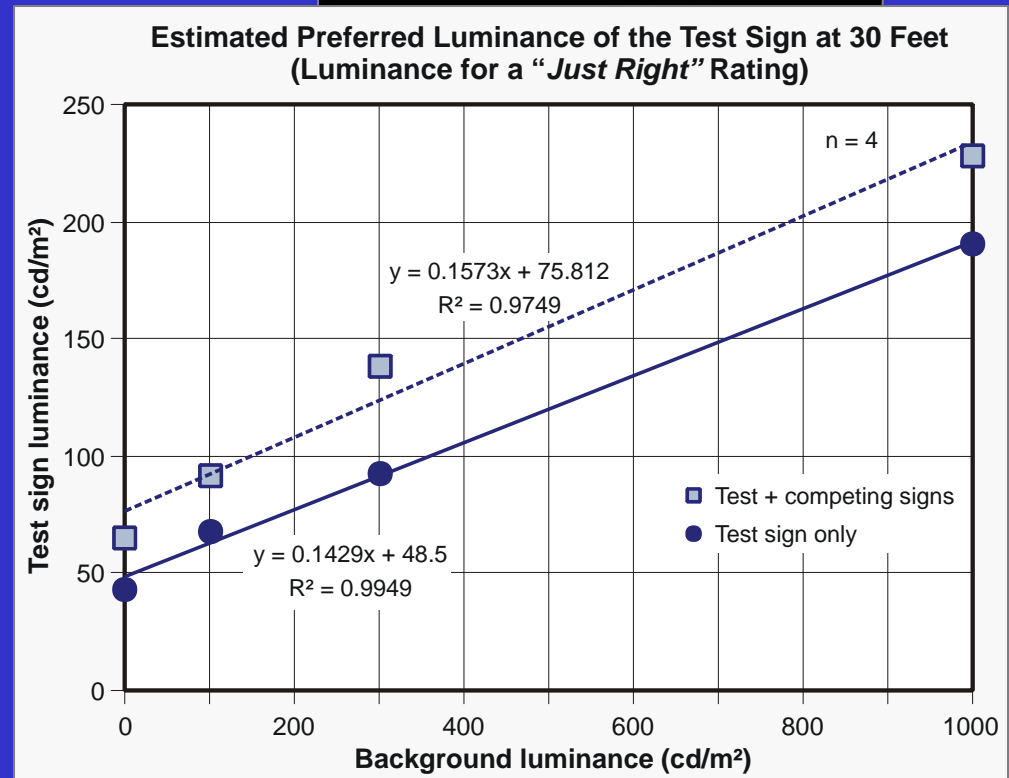
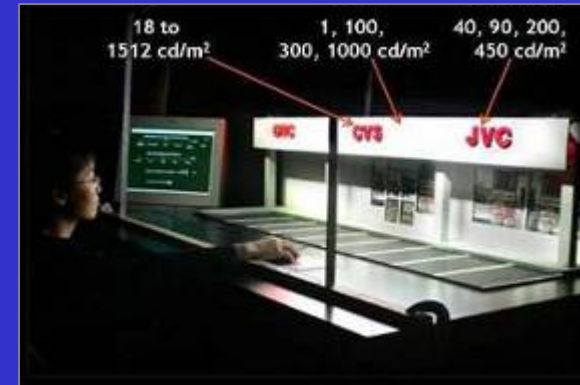


The diffuser alters the light distribution redirecting the light into the desired viewing space thus increasing the amount of useful light and reducing the required number and/or brightness of the LED sources.

LRC determined a suitable range of luminance for red channel-letter signs

Preferred sign brightness depends on background luminance – brighter backgrounds call for brighter signs

If adjacent signs are present, a higher brightness is preferred
Increased viewing distance increased preference for brighter signs

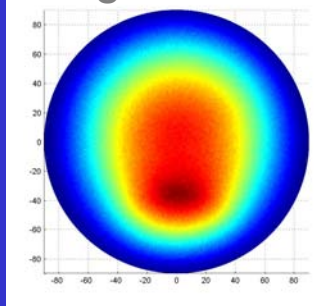


Result: Current laser writing systems cannot create off-axis lenses with very steep and discontinuous slopes, needed to create the asymmetrical beam.

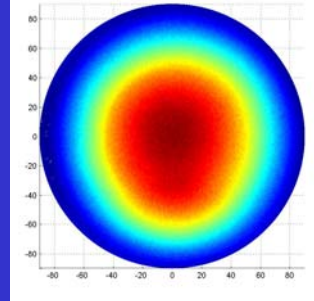
The structures that result act like prismatic structures and scatter light in a direction opposite from that which was intended.

This causes the poor performance of the diffuser and the unacceptably large amount of light scattered above the horizon.

Single diffuser

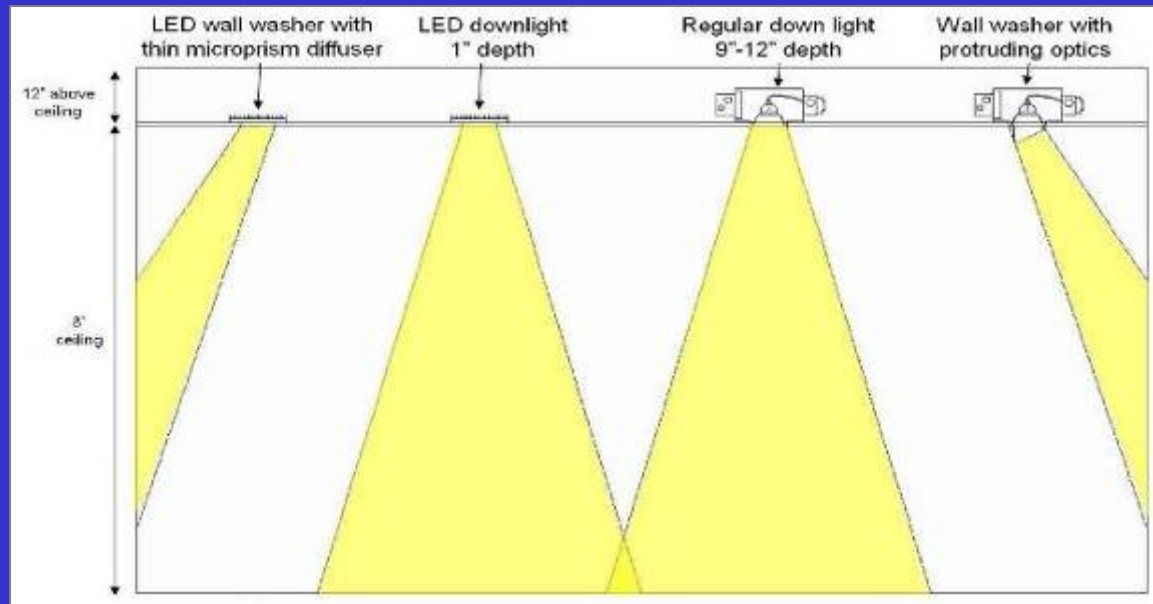


Dual diffuser



Ultra-thin SSL Luminaire RPC Photonics & RPI Lighting Research Center

Goal: Using micro-lenses technology develop an LED downlight luminaire
Wide range of beam distributions
Able to operate on line voltage or low-voltage power supplies
System luminous efficacy: 45 lm/W
Useful lamp-life of over 50,000 hrs
Able to be manufactured and distributed cost-effectively



Status: LEDs identified that minimize heat sink requirements; heat sink materials being evaluated and tile products considered to house the luminaire

PAR 20 Size LED Lamp Driver LED Specialists



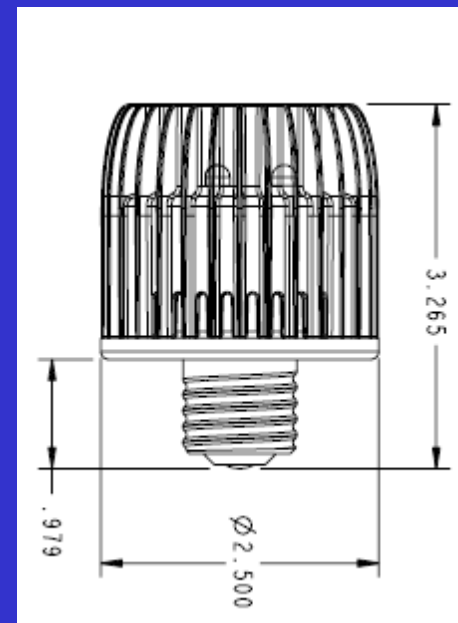
Goal: Develop an LED spot lighting system for indoor/outdoor use, 115VAC, standard Edison base 300 lumens @ 3100K (Available in 2800K – 5000K)

Narrow or wide pattern
83 CRI

9.5 Watts, 32 lms/watt

30,000+ life (in open style fixture)

FCC Class A/B



Status: Working to increase heat sink and reduce operating temperature.

“Discera 400 LED” se’lux

Goal: Develop a high-efficiency SSL parking lot luminaire for pole top installation

Pressure die-cast aluminum housing with integrated heatsink

90 degree field rotatable optics

Tool-less entry into the fixture housing

Stainless steel fasteners and hardware

114 Watt, 42 LED Light Engine Assembly

High and Low power (65 Watt) switchable

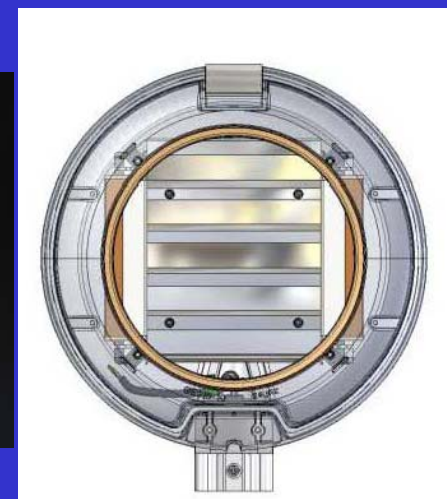
50,000 hour (10+ year) usable life lamp life

Instant on and instant re-strike.

Cold weather performance -30 degrees C

Single unit light engine (power, LEDs, reflector)

Status: August 2007 commercialization



Notch LED Bollard se'lux

33 Watt, 12 LED Light Engine Assembly
High and Low power switchable
50,000 hour (10+ year) usable life
Instant on and instant re-strike
Cold weather performance
-40 degrees Celsius

Status: Prototype fixtures installed
at an apartment building in Tivoli,
NY
Commercialization August 2007



Development of Nanophosphors to Increase the Efficacy and White Color of LEDs Applied NanoWorks

Goal: Identify high temperature nano-crystal growth process parameters that will result in high luminous efficiency non-YAG based, non-heavy metal, phosphor materials (Zn-S-Se-Te-O based compounds)

Fine tune chemical composition, particle size, size distribution, particle morphology, crystallographic phase, purity

Phosphor Evaluation & Benchmarking

(Strong Collaboration with Lighting Research Center, RPI)



Results: Mean efficacy increased 82%
for UV light and 24% for blue light
More R&D work is necessary
Improve quantum efficiency of
phosphor
Reduce self-absorption
Degradation issues
Increase batch yield

Phosphors for High Efficacy Green LEDs Applied NanoWorks & RPI Lighting Research Center

Goal: Phosphor with quantum efficiency exceeding 80%
Peak emission at 555 nm
Strong absorption for excitation wavelengths in the 400-460 nm range
Green Phosphor LED exceeding 90 lm/W

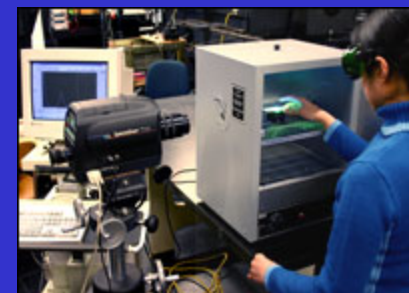
Current status: 50 lm/W with peak emission at 535 nm
High efficiency Green Phosphor will also boost overall lumens and efficiency of White LEDs for general Solid State Lighting (SSL)
Thin film phosphors for precise efficacy control

Develop Quantum Dots for LEDs Evident Technologies & RPI LRC

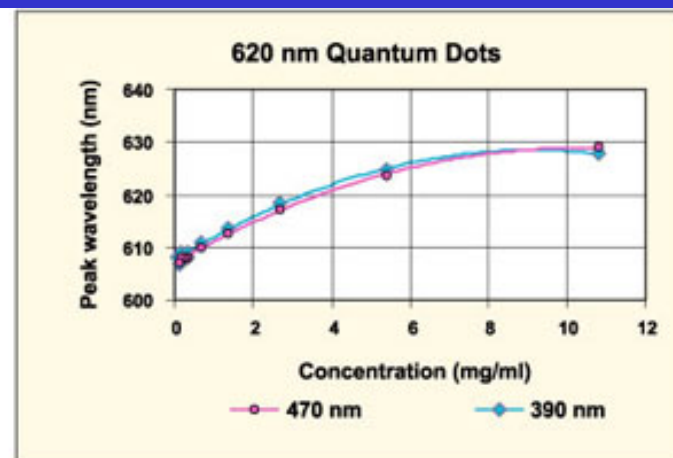
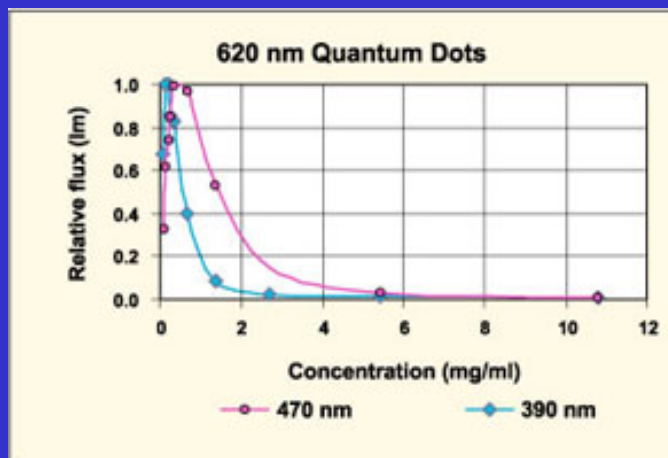
Goal: Develop CdSe-based quantum dots (QDs) to boost the efficacy and white color of LEDs, and compare those with YAG phosphor.

QDs are potential candidate for white LEDs; they behave like phosphors but their wavelength can be tuned by adjusting the size of the QD.

Results: Self-absorption at high concentrations reduces the efficiency of QDs. The efficiency of the QDs tested was much lower than that of YAG:Ce phosphor.



Relative light output and peak wave-length vs. concentration



Market transformation

- LED Lighting for Freezer Cases

LED Lights in Grocery Cases

LED lighting is used inside the grocery cases in place of fluorescent strip fixtures. LED lights have a longer life span than fluorescent lights, produce less heat, and use significantly less energy than typical grocery case lighting.

Retailers are presently evaluating LED freezer case lighting

Freezer case manufacturers are offering LED lighting as an option

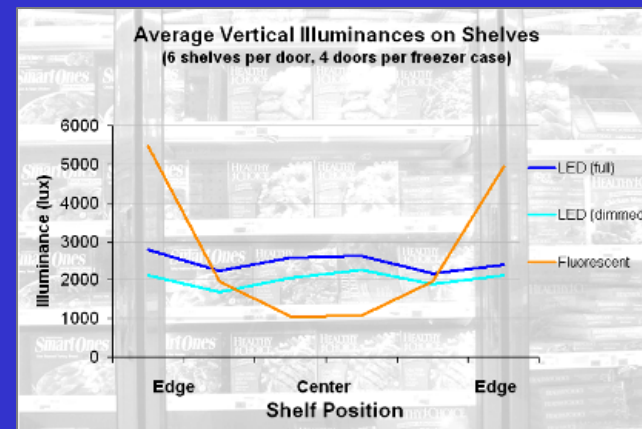
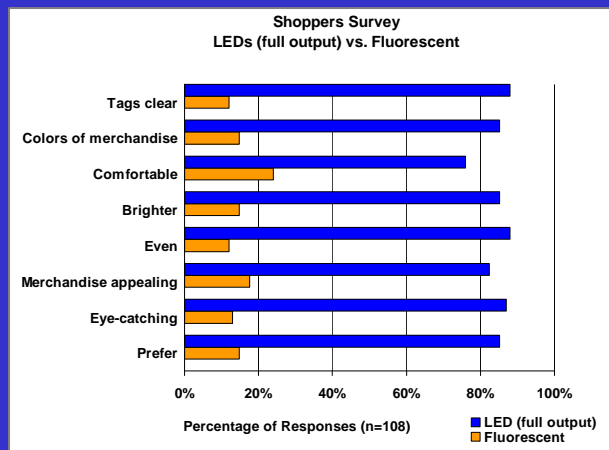
Several commercial LED freezer case lighting products



GE Lumination's
LED Freezer case lights

LED Lighting for Freezer Cases RPI Lighting Research Center

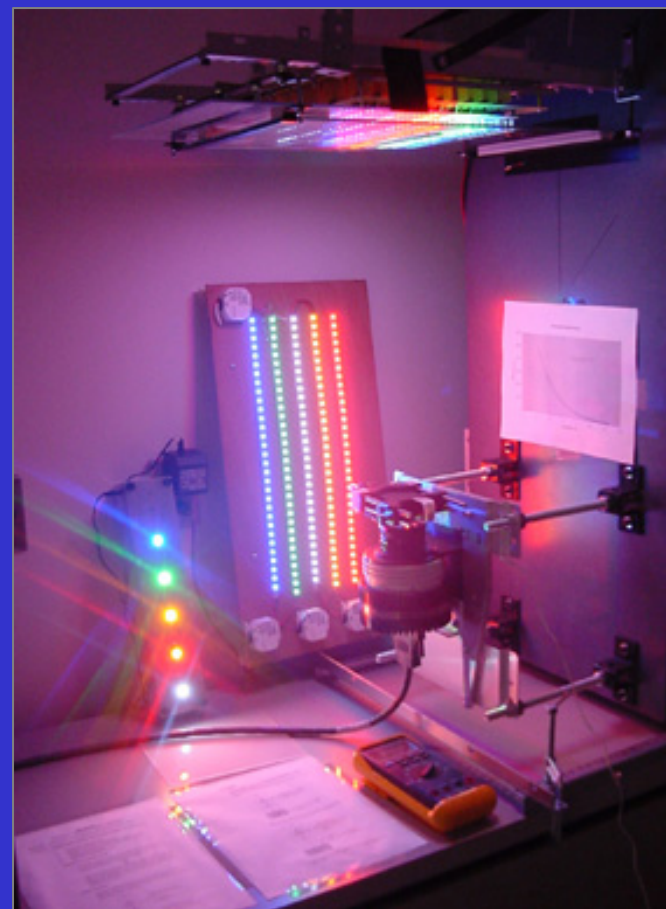
Field demonstration in grocery freezer cases
LED showed better uniformity on merchandise
Shopper surveys: LED overwhelmingly preferred
Sales did not increase
Energy: LEDs beginning to overtake fluorescent in freezer cases



Alliance for Solid-State Illumination Systems and Technologies ASSIST

Facilitating the broad adoption of LED
technology by original equipment
manufacturers (OEMs) and specifiers by:
helping to reduce major technical hurdles
identifying key applications for energy-
efficient solid-state lighting technologies

ASSIST *program*



ASSIST Metrics RPI Lighting Research Center

ASSIST *program*

ASSIST is conducting research to develop information that can be useful for metrics and setting standards.

ASSIST Recommends

When standard definitions and metrics for LED technology are not available, ASSIST develops and publishes recommendations.

The recommendations are developed through research conducted on behalf of ASSIST by the LRC.

ASSIST Recommends

ASSIST *program*

ASSIST Recommends helps manufacturers present meaningful information to end users in a consistent manner.

ASSIST also publishes application guidelines to help end-users select and apply LED technology successfully.

Volume 1: LED Life for General Lighting

Volume 2: Under-cabinet Lighting

Volume 3: Directional Lighting

To come: Outdoor lighting, refrigeration lighting

ASSIST Infrastructure Change

To reap the maximum benefits and expand the use of energy-efficient solid-state light source technologies LED lighted walls and ceilings using a snap-in electrical grid configuration Change lighting as easily as moving furniture and accessories



LED Lighting Institute

Three-day, hands-on workshop on LED technology and applications

Conducted twice a year for lighting professionals, architects, engineers, marketers, specifiers

The LED Lighting Institute

September 2001 The Lighting Research Center
Troy, New York

Preliminary Sponsors

GE
Lumileds
Opto Technology Inc.
OSRAM SYLVANIA Inc. / OSRAM
Opto Semiconductor Inc.
New York State Energy Research
and Development Authority
(NYSERDA)

The Lighting Research Center (LRC) and LED (light emitting diode) manufacturers are joining together to hold the first ever LED Lighting Institute. At the Institute, LRC experts will provide 2-days of instruction for lighting fixture designers and manufacturers, lighting specifiers, and others interested in learning more about this quickly evolving lighting technology. The LRC has designed the course to provide in-depth training and hands-on experience in working with the latest LED technologies for a variety of applications.

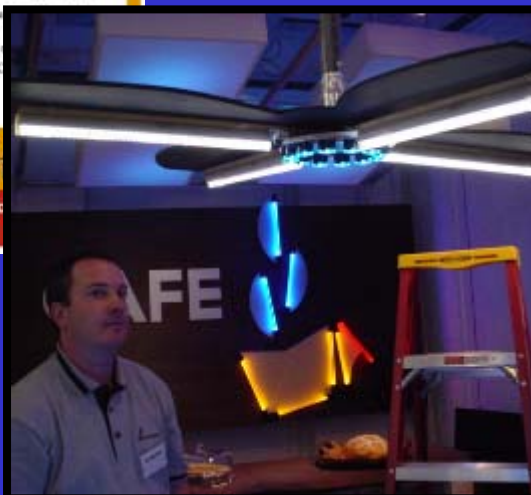


Benefits to Students

- Observe hands-on demonstrations of a full range of LED technologies used in a variety of applications
- Learn to design lighting fixtures and installations using LED's
- Learn to select and specify LED lighting system components
- Experiment with LED technology using computer-based optical modeling and by building a mock-up



For more information
call (518) 607-6100



FUTURE NYSERDA R&D PROJECTS 2007-2009

Solar LED lamp post demonstration

Sullivan Renaissance, HADCO, & Solar One

Nanophosphor LED based backlight for energy efficient LCD displays

Applied NanoWorks & RPI Lighting Research Center

Polarized LEDs for backlighting LCDs

Troy Research Corporation

U. of Rochester & Eastman Kodak

NYSERDA Solid State Lighting Residential Sector Promotion

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Residential Sector

- Philosophy
- SSL in Promotion
- LED Holiday Lighting

Philosophy

- Great technology...

ENERGY STAR® certification

Very energy efficient

Lot of Industry Buzz

- “Potential to be superior to the CFL”
- “Unique”
- “Revolutionize industry”

Philosophy

- ...but are we ready?

ENERGY STAR®

Areas we think we need work

- Price
- Testing
- White Light
- Color consistency
- Light Output compared to incandescent bulbs

SSL in Promotion

- First adopters

New technology (Car rule)

Promote with caution

- Everyone else

“Bigger things” on the horizon

Promote positives

SSL in Promotion

- Some applications can be promoted

Night-lites

LED Holiday lighting

Solar LED lights

Flashlights

- Major improvement from what the market offers today



SSL in Promotion

- Once we're ready, we'll ...

Create demand

- Marketing/Outreach
- Lighting Design

Then stimulate supply

- Manufacturer/Retail partner support

LED Holiday Lighting

- Easy to promote

Consumers like the product

Supply ran out early December

- Savings are visible

- Media likes the technology

LED Holiday Lighting

- Schenectady City Hall
- Community Outreach network assisted in outfitting City Hall with over 500 LED bulbs



LED Holiday Lighting



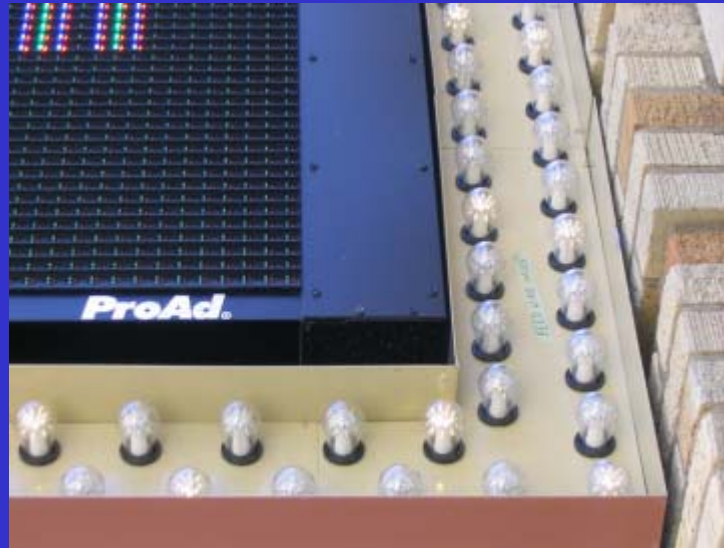
- Stillwater Model Home
- Over 1,500 LED lights on an ENERGY STAR model home

LED Holiday Lighting

- Town of Tonawanda
- Holiday Lighting Contest for residents and schools



NYSERDA Solid State Lighting Commercial & Industrial Sector Activities



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NLPIP LED Lighting Answers

National Lighting Product Information Program



NLPIP series publication that answers some commonly asked questions about lighting systems using LEDs. Lighting Answers: LED Lighting Systems helps practitioners understand the differences between LEDs and other conventional light sources, as well as some of their relevant performance characteristics. Key issues important to understanding the effective use of LEDs are described.

Lighting Research Center

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NLPIP **Lighting Answers**

Volume 7 Issue 3 May 2003

LED Lighting Systems

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Abstract

This publication answers some commonly asked questions about lighting systems using light emitting diodes (LEDs). *Lighting Answers: LED Lighting Systems* helps practitioners understand the differences between LEDs and other conventional light sources, as well as some of their relevant performance characteristics. Key issues that are important in understanding the effective use of LEDs in lighting applications, including electrical performance, thermal performance, and optical performance are described. This publication should be useful to any practitioner who wants to use LED systems effectively in lighting applications.

Introduction

Light emitting diodes (LEDs) were first developed in the 1960s, but only in the past decade have LEDs had sufficient intensity for use in more than a handful of lighting applications (Stingfellow and Crawford 1997), and specifiers are confronted with an increasing number of lighting products that incorporate LEDs for certain applications. Primarily, these applications have taken advantage of the characteristics of LEDs that have made them most suitable for **indication**, not **illumination** (Siemens 1998).

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Next

<http://www.lrc.rpi.edu/nlpip/publicationDetails.asp?id=885&type=2>

SSL Projects

- **Current incentives**

Programs for new construction, existing buildings,
and peak load management can incorporate SSL

Not actively promoting

Limited activity

- **Clinton Foundation project in NYC as a possible demonstration**

SSL Projects

- Palace Theater, Proctors Theater, and Bardavon Opera House marquees
- Glens Falls Civic Center



- NYSERDA is supporting a variety of activities
- It's early ...
- There are many issues to be resolved ...
- Consumers are beginning to express interest ...

Questions??